AIAA 5th Aviation, Technology, Integration, and Operations Conference (ATIO)
26 - 28 September 2005, Arlington, Virginia

AIAA 2005-7346

Atmospheric Power Cycle

By Robert D. Hunt, Private Inventor and
Chairman of Hunt Aviation, Corporation
Chief Scientist for Encore Clean Energy (Stock Symbol ECLN – OB)
The Abell Foundation's OTEC Intellectual Property Consultant
Pass Christian, Mississippi 39571 USA

High altitude flight may be powered by an "Atmospheric Power Cycle" that uses the natural temperature decrease from a low elevation to a high altitude in the same manner that ocean thermal energy conversion (OTEC) technology generates power from the Delta T of warm shallow sea water that contains stored solar energy and cold deep water for heat rejection. The high temperature reservoir for the Atmospheric Power Cycle harnesses the thermal energy contained in ambient higher temperature air (solar energy stored in the air) at low altitude to provide the power source and the cooler air at a higher altitude forms the low temperature reservoir, which acts as the heat sink for the Atmospheric Power Cycle. Upward gliding flight is initiated by aerostatic lift provided by a low-boiling-point-liquid working fluid that is vaporized, using the ambient temperature heat of low altitude air, into a lighter-than-air lifting gas that allows altitude to be gained. Lighter-than-air water vapor at below atmospheric pressure is proposed as a condensable working fluid. Alternately a mixture of water vapor with a low concentration of gaseous ammonia may be used as a working fluid to provide greater pressure as the vapor partial pressure of the ammonia is much higher. Both of these low density gases are lighter-than-air and the ammonia acts as a pressure equalizing gas to evaporate the water into vapor at a much lower temperature with the approximate lift of a hot air balloon at low altitude and much greater lift than a hot air balloon at high altitude as the pressure decreases. The temperature dramatically falls via the Lapse Rate within the Troposphere as high altitude is attained. Heat rejection to the cold air allows phase change condensation of the lifting gas or gases to the dense liquid state that causes the loss of lift as cold air fills the area that was previously occupied by expanded lifting gas and gliding downward flight is achieved. The working fluid is insulated from the ambient temperature of the surrounding atmosphere during the climb to high altitude and during the decent to prevent unwanted premature condensation or vaporization until the desired altitude is reached. Phase change of the working fluid is performed by heat exchangers that take in heat or reject heat to the atmosphere. A chart presenting the Carnot thermal efficiency of the Atmospheric Power Cycle based on the Lapse Rates of the Troposphere, Stratosphere, and Mesosphere is presented that extends from sea level upward through the Mesosphere to 88 kilometers (288,640 feet) that clearly demonstrates that high altitude flight can efficiently be powered by an Atmospheric Power Cycle.

Nomenclature

T_H	=	highest temperature of a heat driven power cycle
T_C	=	coldest temperature of a heat driven power cycle
K	=	the Kelvin temperature scale
C	=	the Celsius temperature scale
F	=	the Fahrenheit temperature scale
p.s.i	=	pounds per square inch of pressure
BTU	=	British Thermal Units
km	=	kilometers
ft.	=	feet
meter	=	defined as 3.28 feet